Instructor:	Dr. Kyle Kinneberg	**Time:**	MWF 11–11:50AM
Office:	Herman Brown Hall, 452	**Classroom:**	Herzstein Amphitheater
Email:	kyle.kinneberg@rice.edu	**Office hours:**	Mon. & Wed. 3–4PM

Class webpage: OwlSpace page.

Description: Differential equations are used to build mathematical models for real-world dynamical (i.e., changing) systems. By observing the rates of change in the system, along with its state at a particular time, one hopes to understand how the system will evolve. In practice, this can range from being very easy to incredibly complex, and over the centuries many methods have been developed to "solve" certain classes of differential equations.

This course will begin with a study of first-order differential equations: those of the form $y' = f(t, y)$. In some ways, these are the simplest equations to analyze, even though exact solutions may be impossible to write down. Here, we will discuss both qualitative and quantitative analysis, along with methods of approximation, and we will see Picard's theorem on existence and uniqueness.

The majority of the course will be devoted to the study of linear differential equations, which is a class of equations for which solutions can be explicitly found. We will begin this topic with first-order linear differential equations and develop several methods for solving such equations. As we shall see later on, higher-order linear differential equations can be reduced to *systems* of first-order linear equations. This makes it necessary to introduce topics and methods from linear algebra, which will take a significant portion of time. In the end, though, we will develop a method for finding the general solution to linear differential equations.

In the remainer of the course, we will turn to non-linear systems, focusing on a few methods that aid in understand their qualitative behavior.

Textbook: We will follow "Differential Equations and Linear Algebra: Second edition," by Farlow, Hall, McDill, and West quite closely. This is the only required textbook and will be sufficient for the course. All homework exercises will come from it.

Homework: I will assign weekly homework sets, typically due at the beginning of class on Fridays. Homework assignments will be posted to the course's OwlSpace page.

Homework assignments are not pledged, and I encourage you to work together, exchanging ideas on the exercises. However, the write-up that you turn in must be done independently and should reflect your understanding of the material. This also means that use of a solutions manual, calculators, or other mathematical software is not allowed, unless explicitly stated otherwise.

Your homework grades will be based on both correctness and clarity of the solutions. To aid in clarity, I suggest the following:

(i) Briefly state the goal of the problem.

(ii) Justify each logical step.

(iii) Present your solution in a neat format that is easy to read. In particular, do not turn in scratch work.

Late homework assignments will not be accepted. If you will not be able to attend lecture the day an assignment is due, please make arrangements to turn it in early. I will, however, drop your two lowest homework scores.

Exams: There will be two in-class midterm exams and a comprehensive exam.

Midterm 1: Wednesday, February 18
Midterm 2: Wednesday, April 1
Final exam: TBD

The final exam has not yet been scheduled. It is the policy of the Rice Mathematics Department that no final may be given early to accommodate student travel plans.

Exams will be pledged, and the use of books, notes, or any electronic device is not allowed. If you have a conflict with the exam dates (a holiday that you observe, interviews, etc.), you must let me know at least a week in advance.

Any complaints or requests concerning the grading of exams must be made within one week after receiving back the graded exam.

Evaluation: Your final grade will be determined as the maximum of the following:

15% Homework + 25% Midterm 1 + 25% Midterm 2 + 35% Final.
15% Homework + 20% Midterm 1 + 25% Midterm 2 + 40% Final.
15% Homework + 25% Midterm 1 + 20% Midterm 2 + 40% Final.
15% Homework + 20% Midterm 1 + 20% Midterm 2 + 45% Final.

Expectations: I expect that you attend every class and arrive on time. It is your responsibility to stay informed of any announcements, syllabus adjustments, or policy changes made during scheduled classes. Not all announcements will be posted on the class webpage.

In lecture, I encourage you to look for the big picture: to put the material in a larger context that you can remember. You might not follow every detail, but if you know the proper context, you can fill these in on your own. Along these lines, I expect you to study the material at home and read the relevant sections of the textbook.

I also encourage you to make use of your classmates and my office hours whenever you don't understand the material well. Of course, you should seek this help as soon as possible to avoid greater confusion later.

Disability Support: Any student with a documented disability who is seeking academic adjustments or accommodations should speak with me during the first week of class. Such discussions will remain confidential, but the student will also need to contact Disability Support Services in the Allen Center.

Tentative Schedule:

Week 1:
01/12 Section 1.1
01/14 Section 1.2
01/16 Section 1.3

Week 2:
01/19 No class
01/21 Section 1.4
01/23 Section 1.5

Week 3:
01/26 Section 2.1
01/28 Section 2.2
01/30 Section 2.3

Week 4:
02/02 Section 2.4
02/04 Section 2.5
02/06 Section 2.6

Week 5:
02/09 Section 2.6
02/11 Section 3.1
02/13 Section 3.2

Week 6:
02/16 Section 3.3
02/18 **Midterm 1**
02/20 Section 3.4

Week 7:
02/23 Section 3.5
02/25 Section 3.6
02/27 Section 4.1

Week 8:
Spring Break

Week 9:
03/09 Section 4.2
03/11 Section 4.3
03/13 Section 4.4

Week 10:
03/16 Section 4.5
03/18 Section 4.6
03/20 Section 5.1

Week 11:
03/23 Section 5.2
03/25 Section 5.3
03/27 Section 6.1

Week 12:
03/30 Section 6.2
04/01 **Midterm 2**
04/03 **No Class**

Week 13:
04/06 Section 6.3
04/08 Section 6.4
04/10 Section 6.5

Week 14:
04/13 Section 6.6
04/15 Section 6.7
04/17 Section 7.1

Week 15:
04/20 Section 7.2
04/22 Section 8.1
04/24 Section 8.2